chemists, or how many spoilt lecture experiments may be avoided in future by those who possess a silica tube.

This last property of silica and the splintering of quartz find an explanation in the results obtained by Le Chatelier (*Comptes rendus*, cviii. 1046, and cxxx. 1703) and by Callendar. These, as already explained (Fig. 3), show that its rate of expansion is exceedingly low, and, moreover, that at temperatures much above 1000° it contracts when heated. In these circumstances it follows, first, that the strains set up in silica when it is suddenly heated or cooled are comparatively small in amount, and, secondly, that if, for example, vitrified silica be suddenly cooled from 1500° to temperatures below 1000°, the strains set up at the earlier stages of the change must tend to neutralise those produced subsequently. These facts enabled Le Chatelier to predict, a little while ago, the indifference of vitrified silica to sudden change of temperature. But the phenomena had been observed previously and exhibited in this country.

The behaviour of quartz under changes of temperature is also peculiar. This was studied by Le Chatelier in 1889 (*Comptes rendus*, cviii. 1046). From his curves, which are given in Fig. 3, it may be seen that this form of silica expands quite regularly, and much more rapidly than vitreous silica up to 570°, but that at that temperature a sudden expansion takes place which is followed by a steady contraction on further heating.

One of the most important fields in which vitrified silica is likely to be useful is that of thermometry.

Owing to the small coefficient of expansion of vitrified silica the degrees of silica-mercury thermometers will be of greater length in proportion to the volumes of the bulbs than those of

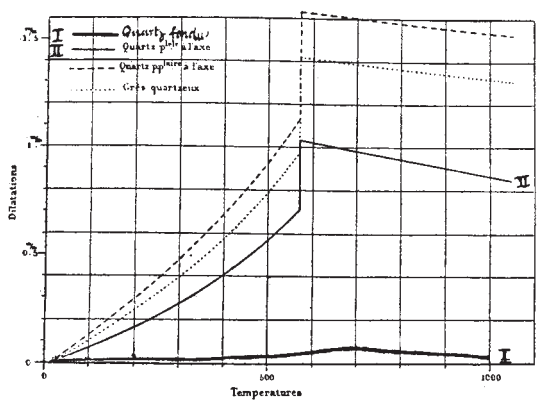

FIG. 3.

glass instruments. Owing to its high melting point it should be possible to employ it with advantage for measuring high temperatures by replacing the mercury by tin or some other metal, as has been done by M. Dufour (*Comptes rendus*, cxxx. 775). And whilst the great elasticity of vitrified silica suggests that the zero points of silica-mercury thermometers will be much more stable than those of glass instruments, the impunity with which it may be suddenly cooled from high temperatures promises obvious advantages.

Finally, the high melting point of silica should make it very valuable for use in platinum thermometers, and I exhibit such a thermometer to-night which has been fitted up for Dr. R. T. Glazebrook. But as the applications of vitreous silica to thermometry are still under investigation I will not dwell on this part of the subject except to add that, as glass reservoirs for air thermometers have proved disappointing, I am not without hopes that the new material may prove helpful in that department also.

We have not yet had time to examine the behaviour of silica with solvents, but if it acts like other forms of the same compound, it may be expected to replace platinum for some purposes, as, for example, for condensers for the preparation of pure water, and vessels of silica probably would be much more suitable for use in exact experiments on the freezing points and boiling points of many dilute solutions than the glass tubes now often used for such work. But, of course, silica vessels would be very susceptible to the action of alkalis. Finally, silica may be expected to prove superior to glass for use in researches on pure gases, owing to the qualities of its surface, and in experiments concerning the behaviour of gases at high temperatures. We have already one small application of silica to research in this latter field to put upon record. It is well known that nitrogen and oxygen enter into combination under the influence of the silent discharge, and Sir William Crookes (*Chem. News*, lxv. 301) has shown that oxides of nitrogen are present in considerable quantities in the flames which accompany the electric discharges of large induction coils; but although various observers have reported indications of the presence of nitrous fumes in the neighbourhood of flames, the forming of an oxide of nitrogen from oxygen and nitrogen alone, and without the intervention of electricity, has not, so far as I am aware, been unmistakably established. Therefore it is interesting to record the fact, first observed by Mr. Lacell, that nitric peroxide may be produced by heating a mixture of oxygen and nitrogen above the melting point of platinum in tubes of silica. It is easy to obtain a gas showing a distinctly yellow colour and exhibiting the reactions of nitric peroxide in this way.

Of course vitreous silica is not entirely without defects. Unfortunately it becomes slightly permeable to hydrogen, as platinum does, though to a less extent (Villard, *Comptes rendus*, cxxx. 1752), at about 1000°. It is attacked when hot by alkaline oxides. It may be heated to about 960° in contact with copper oxide without injury, but at higher temperatures it is attacked. It may be heated more strongly with ferric oxide, but quicklime attacks it at a bright red heat. It is evident that caution must be exercised when it is employed with basic oxides or alkaline solutions. When one first fashions vessels of silica before the flame the vessels exhibit to a greater or less extent a phenomenon resembling devitrification. They become covered with a white opaque crust. This is easily removed by reheating, provided that the tube has been kept scrupulously free from dust and dirt during the process of making it. If this be not done the appearance of the vessel may be spoilt permanently. The earlier observers attributed this phenomenon to the volatility of silica. My impression is that it is connected with the minute traces of alkaline metals present in most Brazil pebble which are usually burnt off in the processes I have described. From what I have told you to-night you will see that in several respects vitrified silica is as much superior to the best glass as Jena glass is superior to more ordinary specimens, and that the progress made in the last few years will make it possible for investigators to employ vitreous silica much more widely in the future than has been possible in the past. At the same time it is evident that the processes for producing vitreous silica are still in their infancy, that there is much more to be done and that further progress can only be made at considerable expense.

In concluding my remarks I wish to express the great obligation I am under to my friend Mr. Lacell. You will have discovered for yourselves that the chief burden has been upon his shoulders to-night, and that without the illumination provided by his precise and beautiful manipulation my discourse would have been but a dry affair. Also I must add that the cost of the work at its later stages has been aided by a subsidy from the Government Grant Fund of the Royal Society.

NOTES FROM RECENT CONSULAR REPORTS.

A REPORT on German East Africa, by Mr. A. C. Hollis, acting vice-consul at Dar-es-Salaam, and one on Veterinary Work in British East Africa and Uganda Protectorates, by Mr. R. J. Stordy, have recently been published as Nos. 2568 and 551 of the Foreign Office Series. The following notes from the reports refer to matters of scientific interest:—

GERMAN EAST AFRICA.

Locusts.—Great interest was shown in the success of the discoveries made at the Grahamstown Bacteriological Institute in the destruction of these insects, and a small quantity of "locust fungus" was imported, and has since been used on Kilima Njaro and in Usambara with success.

Caoutchouc.—There are numerous sorts of caoutchouc creepers and trees indigenous to German East Africa, but the only kinds which are of value are *Landolphia Kirkii* (Kiswahili, *Mohango*), and *Mascarenhasia elastica* (Kiswahili, *Mgora*). Until quite lately it was believed that the best rubber was the product of *Landolphia florida* var. *Comorensis* (Kiswahili, *Mbungo*), but it has now been proved that this creeper is practically worthless.

Samples of the milky juice of the wild fig tree have been sent

to Europe on several occasions, but the price obtained has always been so low as not to repay the cost of transport.

Several trials have been made with other kinds of rubber. *Hevea Brasiliensis* (Para rubber) has been planted repeatedly, but without success, the climate being too dry. *Ficus elastica*, *L. Madagascariensis*, and an *Euphorbia sp.* (from Madagascar) have done fairly well. *Castilloa elastica*, *Hancornia speciosa*, and *Willoughbeia* were each tried once, but the seed did not germinate. *Manihot Glaziovii* (Ceara rubber) was first planted at Tanga in 1891. There are at present about 20,000 trees, but it is feared that it will not pay as the atmosphere is too moist. It is thought probable that Ceara rubber will do better in Donde-Barikiwa (Kilwa district), where a small experimental plantation has lately been opened.

Forestry.—The numerous rivulets and creeks, which form the mouths of the Rufiji River, and which cover an area of 100,000 acres, are lined by extensive mangrove swamps producing the timber known as *boriti*, or Zanzibar rafters. It is the opinion of various botanists that when traders—both European and native—are allowed to cut *boritis* at will, the mangroves in course of time die out, as large numbers of big trees are usually cleared from one spot, thus exposing the young plants to the direct rays of the sun, which is said to kill them. In consequence, the only trees now to be found in various parts of the Rufiji Delta are *Phoenix reclinata Osmunda sp.*, and *Barringtonia racemosa*.

In order to preserve and, if possible, to increase the present supply of *boritis*, a forest officer and three wood-rangers have been stationed in the Rufiji sub-district. The trees are felled under their supervision, and the timber is sold by the German Government.

The custom of systematically stripping a part of the bark from the mangroves, as sometimes practised in the East and West Indies, is not permitted, as it is held that such a course must be injurious to the trees. After the timber has been felled, the bark is stripped and sold.

The regulations issued for the preservation of the woods in the Usambara Hills have done much to prevent the needless felling of valuable timber. Oaks, firs and other European trees are now being planted under the auspices of the Woods and Forests Commission. Similar regulations will shortly be issued for other parts of the colony.

Roads.—Broad roads have been made all over the colony, and it is now possible to drive from Dar-es-Salaam to Lakes Victoria Nyanza and Tanganyika, from Tanga to Kilima Njaro, and from Kilwa and Lindi to Lake Nyasa.

Surveys.—A trigonometrical survey of East and West Usambara has been made, and a map of the former (Handei) is about to be printed. Much topographical work has also been done in various parts of the colony, notably in Uhehe (Hauptmann von Prittwitz), in Usagara (Dr. Stuhlmann), and between the Tanganyika and Nyasa Lakes (Dr. Kohlschüter).

A Commission for the delimitation of the boundary between the Independent State of the Congo and German East Africa left the coast for Lake Kivu in September last. On the completion of the survey of the western frontier, it is hoped that an Anglo-German Commission will be organised to delimit the boundary between the Uganda Protectorate and this colony. The frontier between the British East Africa Protectorate and German East Africa has now been finally settled. An interesting book on the geology of portions of German East Africa, by Dr. Bornhard, was published during the course of the year.

Valuable work is at present being done by Drs. Busse and Kandt. The former is making a study of all the plants indigenous to the country, whilst the latter is exploring the little-known regions between the Tanganyika and Victoria Nyanza Lakes. To him belongs the honour of having discovered the sources of the Kagera-Nile.

Dr. Maurer, after spending three years in German East Africa, has written a lengthy report on the result of his observations, which is being published by the Hamburg Marine Observatory. A successor to Dr. Maurer was appointed in October last. Meteorological observations are regularly taken at a number of places.

Museums.—A museum of products, plants and minerals was established at Dar-es-Salaam in 1899, and has since been increased in size. A collection of the lepidoptera and coleoptera of German East Africa is also being made. The ethnographical museum in Berlin has been greatly enriched by collections received from the colony.

British East Africa and Uganda Protectorates.

Tsetse Fly Disease (*Ngana*).—Mr. Stordy reports that the extent of the tsetse fly belt may be said to be from Mtoto Andei to Simba, a distance of, roughly, 90 miles. The fly is migratory in tendency, so that no well-defined line on the map can be drawn which could safely exclude the possibility of its presence. The fly, however, has never been located further inland than Muani (a halting station in the Kiu Hills on the old caravan route). When studying the causes which rendered the island of Mombasa uninhabitable for horses, Mr. Stordy ascertained that an organism, the morphology of which was identical with that found in animals suffering from tsetse fly disease, was found in donkeys which had been working for some time on the island. The disease has been practically eradicated by the advent of the Uganda Railway, with its excellent service of horse-boxes and fly-proof gauze windows.

Domestication of the Zebra.—Mr. Stordy urges the advisability of utilising for purposes of transport an animal which is naturally immuned against the ravages of the tsetse fly disease and horse sickness, such, for instance, as the zebra, of which there is an enormous number. He adds:—

"I am convinced that, should the Government enter upon a scheme for its domestication, it would prove one of great value, and that at no very distant date a supply of animals would be available, not only for African service, but also for army transport work at home or in India. The great difficulty so far has been the domestication of the adult animal. I have, however, to suggest the following plan for obtaining a possible way out of the difficulty: I would propose that a kraal be formed within a district where firearms are non-existent, as in the case of a preserve. The kraal would have two extending arms leading from the open country into it, and would be constructed large enough to hold a herd of, say, 50 adult animals. Several mounted Cape boys would be employed, whose duty, in the first instance, would be to accustom the zebras in the neighbourhood of the kraal to the sight of horses or mules. If my anticipations prove correct, the zebras will in the course of a few days follow the horses or mules, and advantage could be taken of this to lead them into the kraal. If it were, however, found that they would not be led it would be necessary to have them driven in by the Cape boys, assisted by swift-footed natives.

"The animals being in this way confined within the kraal they would naturally propagate their species. It is with the offspring that I would propose that the experiment in the way of domesticity would begin. As is well known, it has been found nearly impossible to rear a zebra foal apart from its mother. I would not propose to separate them, they would live along with and be nurtured by their mothers. A few months after birth the young animals could be caught and by various ways become accustomed to the sight and presence of man. I am very hopeful that in this way a number of young animals of both sexes would become domesticated and prove useful for transport service, and also in propagating their species. The second generation, if my experiment prove in any way successful, would be even more domesticated than their parents, and I am sure that in course of time a large supply of the domesticated zebra would be forthcoming for the future use of transport work at home and abroad. The initial cost might be a little more than the first results might justify, but there is no reason to doubt that in the long run the ultimate results would far more than compensate for the initial expenditure."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The John Lucas Walker Studentship in Pathology has been awarded to Mr. H. C. Haslam. Dr. E. S. Sladen, who has recently been serving in the Ashanti war, has been reinstated as a second student.

The board for moral science propose the assignment of certain rooms connected with the temporary pathological laboratory for practical work in experimental psychology, under the direction of Dr. Rivers.

A syndicate is to be appointed to consider the question of affording official recognition and support to the work now carried on by the Cambridge Appointments Association.

Mr. W. Bateson, F.R.S., of St. John's College, is to be reappointed deputy for the professor of zoology and comparative anatomy during the ensuing academical year.